

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of

Amendment of Part 15 of the  
Commission's Rules for Unlicensed White  
Space Devices

ET Docket No. 16-56

RM-11745

**COMMENTS OF MICROSOFT CORPORATION**

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## I. INTRODUCTION AND SUMMARY

Microsoft appreciates the Commission's dedication to promoting efficient spectrum sharing between unlicensed users and licensees in the television bands. As the Commission has repeatedly recognized, unlicensed spectrum is a crucial component of the nation's broadband internet infrastructure.<sup>1</sup> White-space operations in the 600 MHz band and remaining television bands represent the last opportunity in the foreseeable future to make spectrum below 1 GHz available on an unlicensed basis, and the rules at issue in this proceeding will determine whether consumer technologies will thrive in this band or not.

Microsoft agrees with the Commission that its rules must unlock the benefits of white-space operations without causing harmful interference to incumbent licensees, including broadcast television stations. Thus, Microsoft understands the importance of the Commission's recent efforts to ensure that the white-spaces databases are free of any errors that could permit a white-space device ("WSD") to operate within the service contour of a broadcaster or other licensee. The following actions the Commission has taken are a sufficient and practical response that addresses any legitimate issues raised in this proceeding:

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<sup>1</sup> *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37*, Report and Order, 30 FCC Rcd. 9551, 9552 ¶ 1 (rel. Aug. 11, 2015) ("Part 15 Order"); *Amendment of Parts 15, 73 and 74 of the Commission's Rules to Provide for the Preservation of One Vacant Channel in the UHF Television Band For Use By White Space Devices and Wireless Microphones*, Notice of Proposed Rulemaking, 30 FCC Rcd. 6711, 6715-16 ¶ 10 (rel. June 16, 2015); *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd. 6567, 6685 ¶ 271 (2014).

- (1) Prescribing validation requirements for fixed white-space devices registration data;<sup>2</sup>
- (2) Codifying a consistent data deletion policy for inactive devices;<sup>3</sup> and
- (3) Developing control and practices around test devices in coordination with database administrators and manufacturers.<sup>4</sup>

It is unnecessary, however, to require all fixed WSDs to incorporate automatic geolocation technologies in order to protect incumbents. Furthermore, doing so will unduly increase costs for consumers, and hamper the development and adoption of unlicensed technologies. Moreover, the facts make clear that the FCC does not need to make changes to its existing fixed white-space rules—these rules more than adequately protect incumbent operations.

The National Association of Broadcasters’ (“NAB’s”) over-the-top proposals to yet again try to hamstring unlicensed operations are a solution in search of a problem. The Commission’s database and operational rules have proven more than adequate to prevent interference by WSDs to licensees, with not a single incident reported in the years that WSDs have been in operation. To be sure, if the Commission adopts reasonable WSD operating rules and provides certainty regarding WSD spectrum availability in other Part 15 proceedings, WSDs are poised to become significantly more common than ever before. But the fact that literally *zero* cases of interference have ever been reported should provide all the record evidence the FCC needs to determine that additional WSDs would not present a significant interference risk.

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<sup>2</sup> See *Amendment of Part 15 of the Commission’s Rules for Unlicensed White Space Devices*, Notice of Proposed Rulemaking and Order, FCC 16-23, ¶ 14 (rel. Feb. 26, 2016) (“NPRM”).

<sup>3</sup> *Id.* ¶ 16.

<sup>4</sup> *Id.* ¶ 15.

In our opposition to NAB's petition, Microsoft worked to constructively address the concerns NAB raised. Fixed TVWS manufacturers, their distributors, and white-spaces database providers all have to comply with the Commission's rules—just as NAB members are required to comply with the Commission's rules. However, NAB's proposed remedies were out of proportion to the actual risks posed. Given the recent steps the Commission has taken to further improve white-spaces database accuracy, NAB's preferred remedies are now even more out of proportion to the risk. In addition, in the highly unlikely event that harmful interference was to occur, the Commission has taken steps to simplify the task of identifying the device responsible, which will facilitate corrective action.

Because its existing rules are more than sufficient to prevent harmful interference, the Commission should not take additional action in this proceeding. But if it does act, the Commission should adopt less burdensome alternatives to mandatory automatic geolocation. In particular, the Commission can provide additional accountability for professional installers by requiring them to register for FCC Registration Numbers ("FRNs") and input their unique FRNs when registering the location of a fixed WSD. This will make it easy for the Commission to identify potentially problematic installers and, in appropriate cases, provide the tools to suspend or revoke an installer's ability to enter geolocation information. This change would not only enhance the Commission's ability to correct erroneous entries retrospectively, but also discipline installers' performance prospectively, further increasing the reliability of data in the database and further reducing the odds of harmful interference.

Additionally, the Commission should not mandate an automatic geolocation requirement for any fixed devices, and it is especially critical that the Commission not impose this restriction on low-power, indoor, fixed WSDs such as home access points. For this class of devices, the

burdens of an automatic geolocation requirement would be especially out of proportion, given the negligible interference risk of indoor devices operating at such low power.

Finally, while this proceeding focuses on the interference potential and location information for low-power devices which pose little interference risk, comparatively little attention is being paid to a far more serious data accuracy problem looming on the horizon: the location and operating characteristics of broadcasters that alter their facilities during the post-auction transition period. Less-than-prompt notification of facility changes would threaten severe interference to other broadcasters, wireless licensees, unlicensed broadband operations, wireless microphones, and other users in the television bands. And, more subtly, delayed or inaccurate notifications of facility changes will vastly complicate and delay the post-auction transition by forcing last-minute changes to other licensees' own transition plans. This problem could be compounded as the effects of unexpected facility changes and resulting interference radiate outwards beyond the initial delayed notification and those stations directly affected by it.

## **II. THE COMMISSION'S LOCATION REGISTRATION RULES SHOULD NOT BE CHANGED**

Among all the competing claims and theories about the accuracy of white-spaces databases, one crucial fact remains undisputed: there has not been a single reported incident of interference caused by WSDs to licensees due to erroneous location information in the white-spaces database.<sup>5</sup> This fact must trump NAB's overheated rhetoric and misuse of past database registrations. Because of this flawless interference record, the technical skill of professional WSD installers, and strong market-based incentives to ensure the continued reliability of

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<sup>5</sup> *Id.* ¶ 15.

professional installers, the Commission should not alter its existing geolocation rules for fixed WSDs.

Indeed, to Microsoft's knowledge, there has not been a single case of a WSD, other than those in shielded test environments,<sup>6</sup> that has not been properly registered at its true operating location—the only type of data error capable of resulting in harmful interference. Instead, close scrutiny of white-spaces database entries has only uncovered instances where additional, unnecessary locations were entered, likely for testing purposes.

The fact that a researcher, manufacturer, or operator entered a limited number of incorrect locations falls far short of establishing that installers of fixed WSDs actually in operation did not ultimately register them at their correct locations. In fact, the most plausible explanation for these incorrect entries is merely that an installer diligently sought to ensure that the WSD in question accurately responded to changes in location and corresponding channel availability. There is no evidence at all that an installer misused the database so they could operate improperly. And there is no reason to suspect that any installer made the effort to validate the proper operation of the device and a white-spaces database in this way and then failed to ever enter the correct device location. The absence of even a single report of harmful interference is strong evidence that operating devices were registered at their correct locations (in addition to incorrect test locations).

The Commission's proposals also ignore the fact that professional installers already have strong incentives to register fixed devices at their true locations. First, devices that are not registered at their true locations will perform poorly. This is because, while the database

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<sup>6</sup> *Id.*

registration requirement is intended to avoid harmful interference to licensees, a co-channel licensee is likely to cause interference to a mis-registered WSD in many circumstances. As a result, a WSD operator could see diminished throughput and reliability—perhaps rendering the WSD entirely unusable—if the device’s location is not entered accurately.

In addition, a professional installer who incorrectly enters an operating device’s location would risk his or her livelihood by potentially exposing clients to adverse FCC action. He or she would also risk the business prospects of the device manufacturer or the manufacturer’s distributor, depending on how the device was sold, as many consumers would be unlikely to differentiate between the installer and manufacturer/distributor of the device in assigning blame. A WSD operator will not likely hire the same professional installer or purchase devices from that distributor again if the installer’s previous efforts resulted in interference complaints, potentially making them the subject of an FCC enforcement action. The Commission’s recent improvements to processes used to verify contact information associated with WSD registrations will only increase the power of this market-based incentive.<sup>7</sup>

The Commission’s rules, therefore, correctly entrust professional installers with the task of entering accurate location information for newly installed fixed WSDs. The complete lack of any reported interference due to mis-registration of fixed WSDs—or even any examples of the type of mis-registration *capable* of permitting harmful interference—proves that professional installers have the expertise and strong incentives to submit accurate location information. And there is no reason to expect that these market forces and this level of technical skill will diminish as WSDs become more widely deployed in the wake of the incentive auction. Indeed, given

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<sup>7</sup> See *Id.* ¶ 13; FCC, Policy and Rules Division, *White Space Database Administration*, <https://www.fcc.gov/general/white-space-database-administration>.

professional installers' 100% success rate in preventing harmful interference to date, there is no reason to believe that professional installation presents a significant interference risk even if fixed WSD deployments increase one-million-fold.

### **III. THE COMMISSION'S PROPOSED AUTOMATED GEOLOCATION REQUIREMENT WILL NEEDLESSLY INCREASE COSTS FOR CONSUMERS**

The Commission's proposed automatic geolocation requirement would unnecessarily increase WSD deployment costs. Although these costs would be borne by all fixed WSD users, individual consumers would be the hardest hit. This is because an automatic geolocation requirement would increase costs in the low-margin home router market, where the rule would also generate the fewest benefits. Accordingly, there is no need to impose an automatic geolocation requirement on any fixed device, and it is especially critical that the Commission refrain from imposing such a requirement on 100 mW indoor fixed WSDs.

As the Commission knows, automatic geolocation presents a significant technological challenge for devices—including fixed WSDs—that must function reliably indoors.<sup>8</sup> Adding a GPS chip to a fixed low-power WSD will not enable accurate determination of indoor location. It would, however, increase costs significantly relative to the low prices and thin margins that prevail in the market for home access points. Indeed, as the Commission knows all too well, the wireless industry has been wrestling for years with issues related to deploying feasible, ubiquitous technical solutions for indoor location accuracy.<sup>9</sup> Personal/portable WSDs may

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<sup>8</sup> NPRM ¶ 23.

<sup>9</sup> See generally Comments posted on PS Docket No. 07-114 (filed between March 28, 2014 and May 12, 2014) (Comments in response to *Wireless E911 Location Accuracy Requirements*, Third Further Notice of Proposed Rulemaking, 29 FCC Rcd. 2374 (rel. Feb.

eventually be able to leverage future geolocation advances, but with today's technology, there is no automatic geolocation solution for indoor fixed WSDs that does not increase costs and greatly complicate installation.

Although the Commission has suggested some potential workarounds that leverage some of the unique characteristics of fixed WSDs,<sup>10</sup> these proposals would increase costs still further and would likely be too complex for widespread consumer adoption. For example, the Commission's proposal to permit the use of external geolocation devices would require consumers to not only purchase a separate geolocation device, but also successfully navigate the task of running a cable from that geolocation device to the WSD.<sup>11</sup> Similarly, the Commission's suggestion that a low-power fixed WSD could be registered initially in a location where its integrated geolocation capabilities are able to obtain accurate location data, and only then moved to its actual intended place of operation,<sup>12</sup> would be difficult for manufacturers to implement and confusing for consumers. In fact, the Commission's proposed location registration procedures for indoor devices are sufficiently complex that professional installation will likely remain necessary as well, further increasing costs.

The Commission must also keep individual consumers in mind when considering whether to impose any requirement to validate telephone numbers and email addresses. While technologies exist to implement such a mandate, some possible implementations of a phone

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21, 2014) (demonstrating the difficulty the FCC has encountered generally in advancing a technology for reliable indoor geolocation.)).

<sup>10</sup> NPRM ¶¶ 23-26.

<sup>11</sup> *Id.* ¶¶ 23-24.

<sup>12</sup> *Id.* ¶ 26.

number and email address validation process might be so cumbersome as to severely limit consumer adoption of low-power fixed white-space technologies.<sup>13</sup> If the Commission chooses to require email address and telephone number validation, it should therefore not require the use of any particular validation method. Instead, the Commission should provide sufficient flexibility to enable WSD manufacturers and database operators to develop technologies that could result in an easy-to-use, but still reliable, validation method.

Finally, Microsoft notes that trade-offs between the certainty of increased consumer burdens (in the form of cumbersome geolocation technologies, email address and phone number validation, or other rules) and the purely hypothetical risk of harmful interference make little sense generally and in particular with respect to the case of fixed, indoor-only, 100 mW devices, which are most likely to be used as in-home 802.11af Wi-Fi access points. Given the low power of these devices and the significant building loss that will shield licensees from these emissions, there is very little risk of harmful interference even in the worst-case scenario. And because these devices are home access points, they are unlikely to ever be moved more than a few meters, further reducing the possibility of interference due to outdated location information.<sup>14</sup>

As with other categories of fixed WSDs, consumers would have little incentive to falsify their location information. Most fundamentally, the typical consumer will not have the

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<sup>13</sup> For example, a process where consumers were required to confirm their email addresses and phone numbers by mail would be unduly cumbersome, when other more streamlined, automated processes are available with which consumers are already familiar.

<sup>14</sup> To account for unusual situations such as a consumer's moving to a new home or, even less frequently, reselling her access point to a different consumer, the Commission could require location information to be reentered after a device is powered off for an extended period of time. (Though requiring location information to be reentered after *any* power interruption would clearly impose the unnecessary burden of requiring consumers to reenter location information after brief power outages and the like.)

information necessary to gain access to additional channels by deliberately misrepresenting location information—indeed, most will probably not be aware that the device’s location influences channel availability at all. And to prevent accidental data-entry errors, WSDs could validate and corroborate user-supplied geolocation data with either the consumer’s street address, IP-based geolocation data, or both.

#### **IV. THE COMMISSION MUST PRESERVE THE PROFESSIONAL INSTALLATION OPTION FOR PROVIDING GEOLOCATION DATA**

Consistent with the evidence already before it, the Commission should take no additional action regarding WSD location information, and must preserve the professional installation option. Specifically, instead of discarding the professional installation rule, the Commission should consider steps to facilitate oversight of professional installers to ensure their continued reliability.

The FCC’s proposed automatic geolocation requirement is highly unusual among radiocommunications services. The Commission’s rules entrust wireless licensees, broadcasters, WMTS operators, and operators of many other devices that intentionally transmit radiofrequency energy with the responsibility of accurately reporting the locations of their transmitters, despite the fact that they operate at, in some cases, *millions* of times the power of even the most powerful WSD.<sup>15</sup> The difference, of course, is that the Commission’s licensing process for these

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<sup>15</sup> See, e.g., FCC, TV Station Profiles & Public Inspection Files, *Television Broadcast Station License: KDCU-DT* (2010), <http://data.fcc.gov/mediabureau/v01/tv/authorization/1328926.pdf> (license renewal available at <http://data.fcc.gov/mediabureau/v01/tv/authorization/1620551.pdf>) (station licensed to transmit at 1 MW).

types of operators establishes a clear and direct mechanism to hold these operators accountable if they mis-register their transmitters' locations.

The Commission can ensure similar accountability for fixed WSD location installations by requiring professional installers to register for FRNs and submit their FRN along with any location information they submit to a white-spaces database. The registration process will enable the Commission to verify that it has accurate and up-to-date contact information for every professional installer, ensuring that the installer can always be contacted in the unlikely event of an interference complaint. In addition, the use of an FRN would make clear that the FCC has jurisdiction over professional installers, enabling the Commission to apply a wide range of sanctions against installers who submit unreliable information.<sup>16</sup> And, in extreme cases, the Commission could easily suspend or terminate a professional installer's ability to enter location information by revoking the installer's FRN, or "blacklisting" it in white-spaces databases.

Perhaps more importantly, such a process would ensure that professional installers recognize the possibility that they will be held accountable should they enter false geolocation information. This, combined with the market-based dynamics described above,<sup>17</sup> would provide additional assurance that professional installers will continue to be diligent and accurate in submitting geolocation data to white-spaces databases.

Finally, requiring professional installers to apply for and submit FRN data would be a reasonable and appropriate regulatory response given the slight risk of potential interference. Instead of imposing a broad technological mandate that effects every manufacturer and operator

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<sup>16</sup> If there is any doubt whether the Commission could take these steps under existing rules, it could simply add submissions made by professional WSD installers to the representations covered by the Commission's attestation rules, such as 47 C.F.R. § 1.16.

<sup>17</sup> See *supra* pp. 5-6.

of WSDs—including consumers—increasing accountability for professional installers would create no new technological challenges, and impose only a small burden on a far smaller group. Moreover, professional installers will be well equipped to understand and cope with the simple task of registering for an FRN and submitting it with each WSD registration.

**V. THERE IS NO REASON TO MODIFY THE DEFAULT LOCATION ACCURACY REQUIREMENT FROM  $\pm 50$  METERS TO  $\pm 100$  METERS**

The Commission asks whether there is any need to increase minimum WSD accuracy from  $\pm 50$  meters to  $\pm 100$  meters.<sup>18</sup> There is not. As the Commission points out, it has recently adopted rules to accommodate devices that cannot achieve geolocation accuracy of  $\pm 50$  meters. For these devices, the Commission permits the device to operate, but requires that white-spaces databases incorporate this added uncertainty into any applicable separation distance.<sup>19</sup>

The Commission correctly determined that this rule change obviates any need to change the minimum location accuracy to  $\pm 100$  meters.<sup>20</sup> Unlike the regulations in effect when NAB and certain WSD manufacturers filed their joint proposal to modify the Commission's geolocation rules, the flexible rules in effect today already permit devices with location uncertainty of more than  $\pm 50$  meters,<sup>21</sup> and no change in the rules is necessary to accommodate such devices. Indeed, relative to today's rules, mandating location accuracy of  $\pm 100$  meters would actually *increase* the

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<sup>18</sup> NPRM ¶ 30.

<sup>19</sup> Part 15 Order at 9581-83 ¶¶ 75-78.

<sup>20</sup> NPRM ¶ 30.

<sup>21</sup> See Letter from Haiyun, Tang, Adaptrum, Inc.; James Carlson, Carlson Wireless Technologies, Inc.; Larry W. Koos, Koos Technical Services, Inc.; Jordan Du Val, MELD Technology, Inc.; and Rick Kaplan, National Association of Broadcasters, to Julius P. Knapp, Chief, Office of Engineering and Technology, FCC, ET Docket No. 14-165 and RM-11745 (filed July 17, 2015).

burdens on WSD manufacturers and reduce the value of WSDs for consumers. This is likely the precise opposite of what the parties to that agreement intended.

Moreover, as Microsoft has explained, the flexible location accuracy rules that the Commission adopted in its Part 15 Order strike the right balance between preventing interference, encouraging innovation, and reducing costs for consumers.<sup>22</sup> Because the Commission's rules require any applicable separation distances to be increased to account for location uncertainty in excess of  $\pm 50$  meters, they in no way undermine the separation distances used to protect broadcasters and other licensees from harmful interference. In fact, this rule actually increases these protections since it makes the unrealistic, worst-case assumption that the device is always as close to the relevant licensee as possible, given the applicable location uncertainty.

On the other side of the balance, the Commission's flexible location uncertainty rules allow market differentiation between different types of WSDs, giving manufacturers the opportunity to make trade-offs between location accuracy (and, thus, channel availability), battery life, and cost, among other variables. This means greater choice, and potentially lower costs, for consumers.

There likely is an upper limit on the level of location uncertainty that will prove viable in the marketplace, as devices with higher location accuracy will be best able to find available channels of operation. But there is no reason why the Commission should attempt to identify and mandate that threshold by rule. Because the Commission's regulations ensure that increased location uncertainty does not result in increased interference risk, there is absolutely no reason

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<sup>22</sup> See Response and Opposition to Petitions for Reconsideration of Microsoft Corporation at 21, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 29, 2016).

not to allow the market to identify the location certainty values that are most appropriate for existing and future white-space deployments.

## VI. CONCLUSION

The existing track record of white-space technologies demonstrates that the white-spaces database system will effectively prevent harmful interference to licensees. Despite sensationalist claims by NAB, the indisputable fact is that white-spaces databases, with data provided by professional installers, have proven 100% effective in preventing harmful interference, with not a single documented instance of harmful interference due to erroneous data. At worst, white-spaces databases have included superfluous information, a “problem” that poses no risk of harmful interference, and that warrants—at most—the minor regulatory adjustments described above. The Commission therefore must not take the drastic step of eliminating the professional installation option, which would radically increase complexity and cost for consumers with no offsetting benefit.

Respectfully submitted,

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